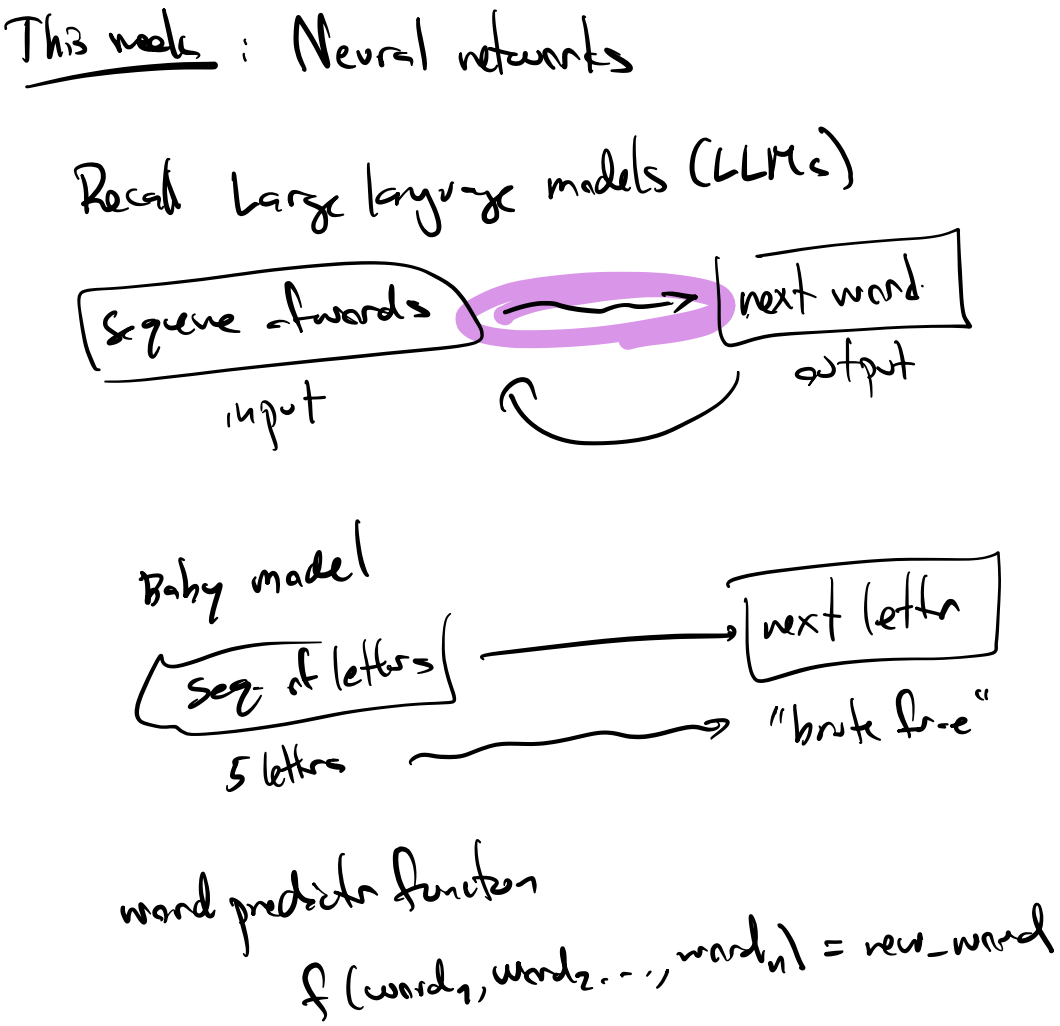
Puzzler

A downstairs panel contains three on-off switches, one of which controls the lamp in the attic—but which one?

Your mission is to do something with the switches, then determine after one trip to the attic which switch is connected to the attic lamp.



Today:

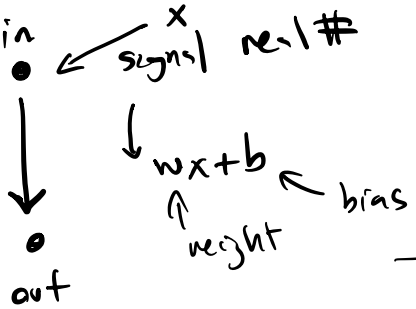
Basic neural net architecture concepts

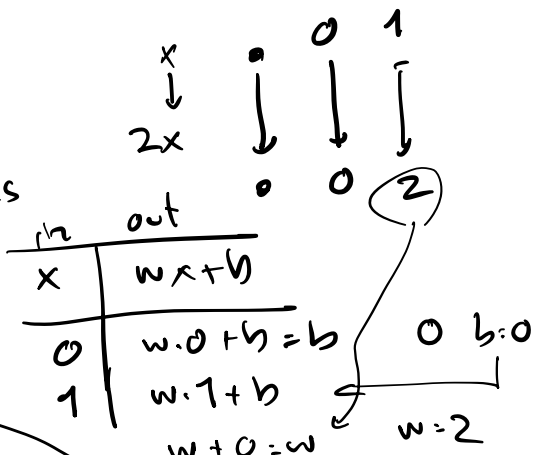
Start on "training"

Numerical approximations to solutions of nonlinear eqns.

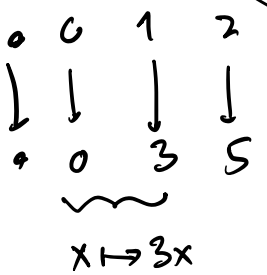
"gradient flow"

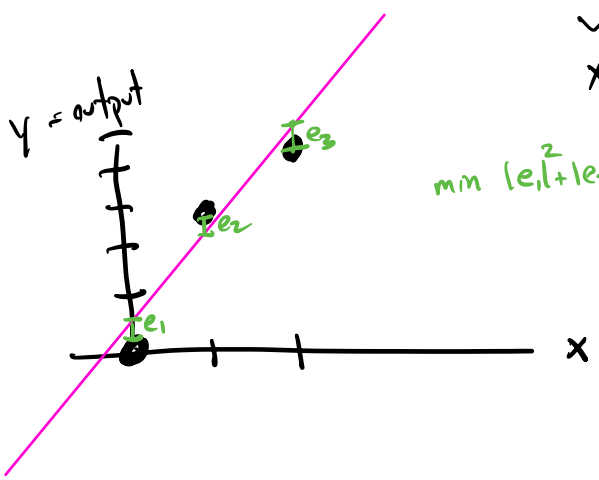
Neural nets by toy examples



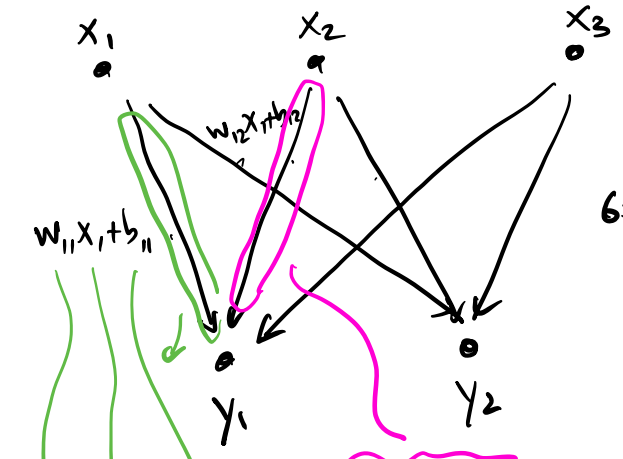


Potential problem:

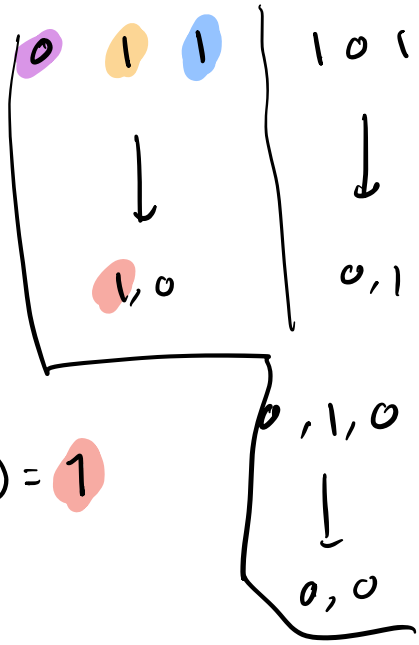




$\min |e_1|^2 + |e_2|^2 + |e_3|^2$

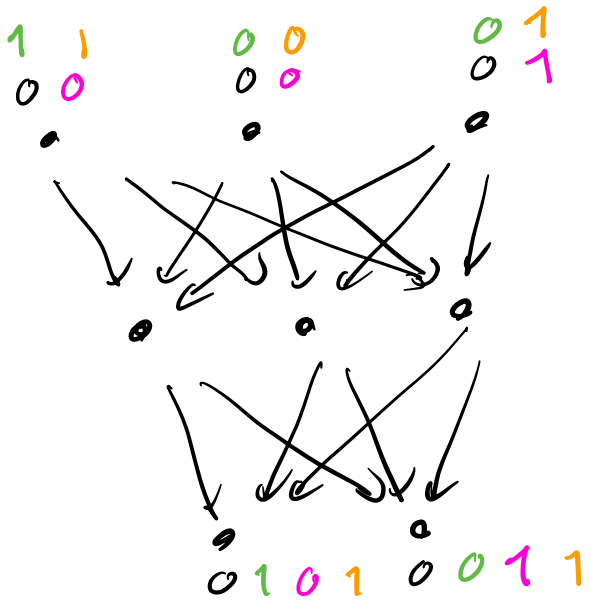


$6 \times 2 = 12$ parameters w's b's.



$$(w_{11} \cdot 0 + b_{11}) + (w_{21} \cdot 1 + b_{21}) + (w_{31} \cdot 1 + b_{31}) = 1$$

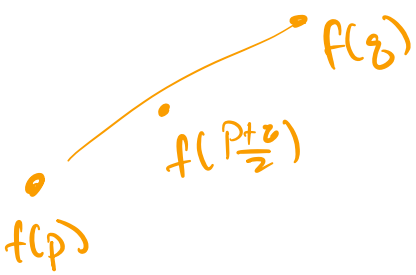
$$b_{11} + w_{21} + b_{21} + w_{31} + b_{31} = 1$$



$15 \times 2 = 30$ parameters!!

Need new feature:

Nonlinearity



$\mathbb{R}^2 \longrightarrow \mathbb{R}$

$(x,y) \longmapsto ax+by+c$

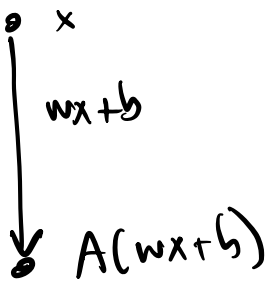
$(0,0) \longmapsto 0 = c$

$(1,0) \longmapsto 1 = a+b\cdot 0+0 = a$

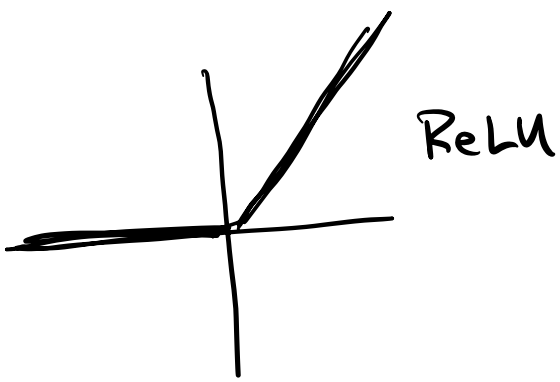
$(0,1) \longmapsto 1 = a\cdot 0+b+0 = b$

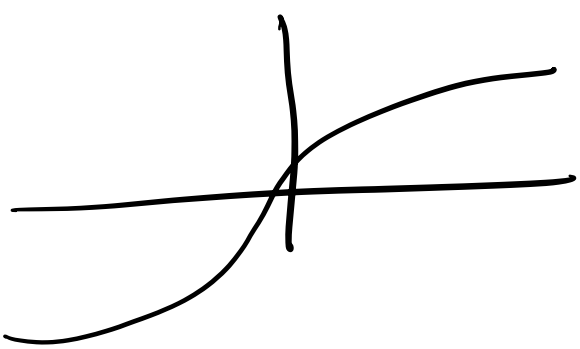
$x+y$

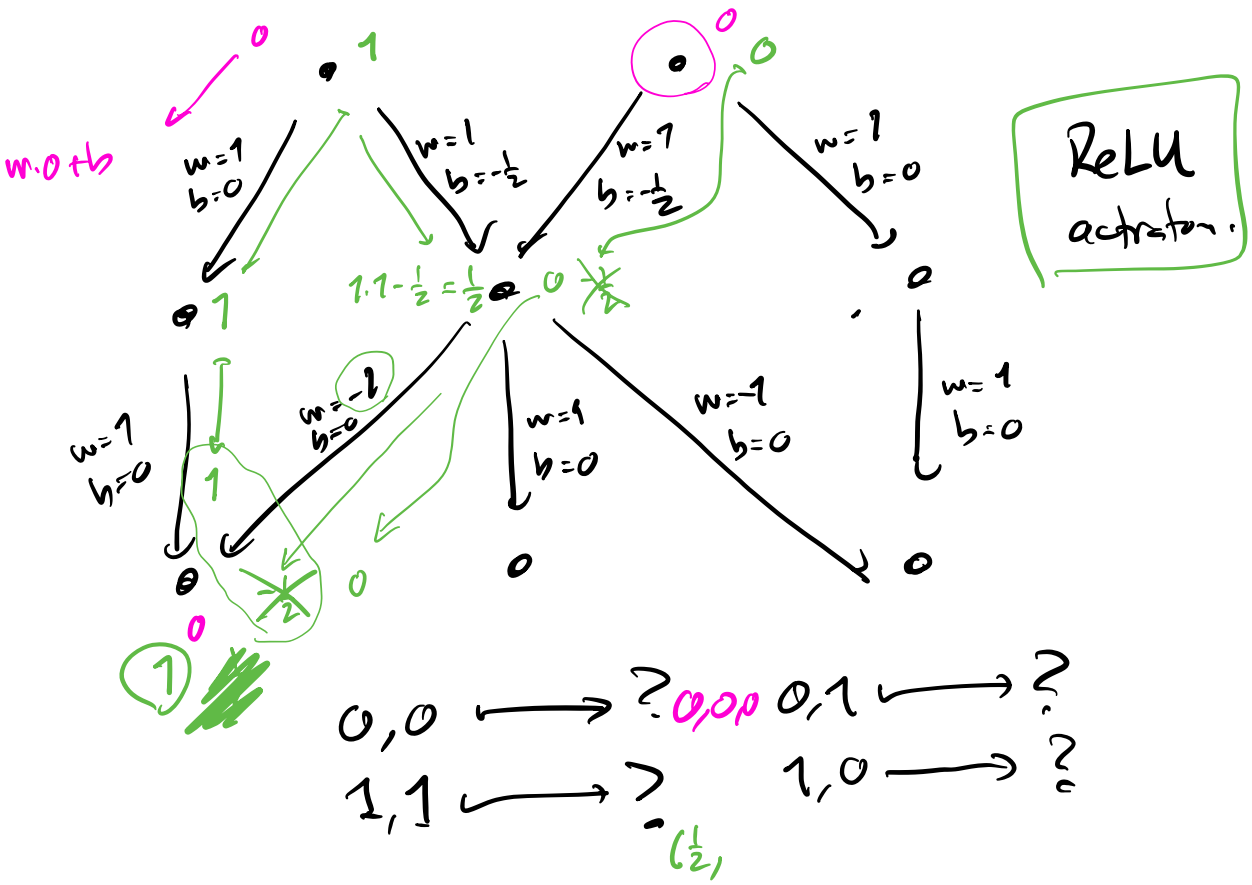
$(1,1) \longmapsto 2$



$A(x) = \max\{0,x\}$






w·0+b
w=1 b=0
w=1 b=-1/2
w=1 b=-1/2
w=1 b=0
ReLU
activation
1·1-1/2=1/2
w=1 b=0
w=-1 b=0
w=1 b=0
w=-1 b=0
w=1 b=0
w=1 b=0
0,0 → ? 0,0p
0,1 → ?
1,1 → ?
1,0 → ?
(1/2,